SOILutions

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NITROGEN FERTILIZER ON FORAGES

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Last fall, we described some general fertility requirements for forage production. Here we will delve into nitrogen nutrition in more detail. Keep in mind that nitrogen is the most commonly deficient plant nutrient and of all the factors you can control, nitrogen has the greatest impact on forage production.

Let's start with a review of the basics. All forage crops require nitrogen for growth. However, legumes fix their own nitrogen, so not all forage crops require nitrogen fertilizer. In fact there are three sources of nitrogen for forages: nitrogen mineralized from soil organic matter, manure or crop residues; nitrogen applied as fertilizer; and nitrogen fixed by legumes.

Perennial grass forages have a high nitrogen requirement. Mineralization of soil nitrogen is slow in established stands and insufficient to produce high yields. This is often indicated by very low soil test nitrogen levels. Nitrogen released from organic reserves during the growing season is consumed immediately by the plants. As a result, there is no build up of soil test nitrogen.

Since mineralization cannot meet crop demand, nitrogen supplied by fertilizer becomes very important for achieving

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PURPLE LOOSESTRIFE MANAGEMENT IN ALBERTA

Shaffeek Ali, P.Ag.

Ever since purple loosestrife (*Lythrum salicaria*) was inadvertently introduced to North America from Europe in the early 1800's, its range has been expanding at the expense of native wetland plant species. Its ability to force out native species leads to a decline in wildlife food and lower wildlife value for many wetlands.

At present, the infestations of purple loosestrife in Alberta are quite small. Only twenty-two sites have been reported and they range in size from one plant to five acres. So Alberta still has an opportunity to prevent the problem rather than to have to try and control an already existing problem. Which is good because loosestrife is a difficult plant to control.

The difficulties in controlling loosestrife are due to its versatile growth habit. Established loosestrife plants have a large heavy stem. Regrowth occurs annually from the root after winter die-back of above ground parts. The plant can reproduce by seed or by cuttings. Seeds are extremely small and a single plant can produce up to two million seeds. Seeds can float a long way before they sink. They can spread by wind across snow, by water, by wildlife or humans. Cuttings establish easily. A cutting placed in water will grow roots in a few days.

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Alberta
AGRICULTURE, FOOD AND RURAL DEVELOPMENT

maximum yield of grass forages. Generally, grass forages respond dramatically to fertilizer nitrogen particularly so in the moist regions of Alberta. We all like a little drama but what we need is the maximum return for our fertilizer dollar. This means we have to manage nitrogen fertilizer for optimal effectiveness and effectiveness is strongly influenced by rates, sources, times and methods of application. That's at least four decisions that have to go into a best fit management plan for every forage stand.

Let's start with a discussion of rates. A typical response of grass forage to nitrogen, using data from central Alberta, is illustrated in Figure 1. The biggest jump in yield occurs with the first fifty kilograms of nitrogen, but notice that yield did not stop increasing until two hundred kilograms had been applied.

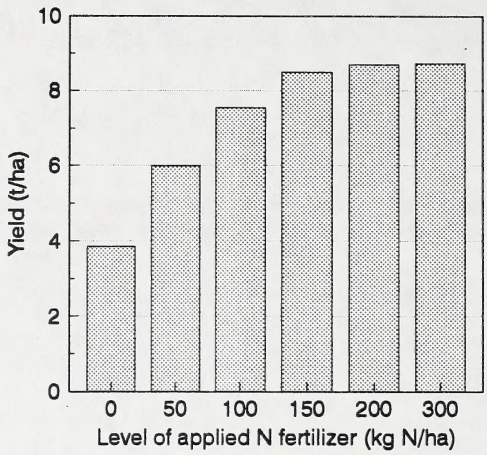


Fig. 1. Yield response to N fertilizer

Frequency of application is also important and in general the more frequent the better. Smaller annual applications will produce higher and more consistent yields than equivalent single nitrogen applications made every three or four years. (See Figure 2. Yields are totals over four years.) If you regularly get two or more cuts of hay, it's good strategy to go one step further, splitting the annual application in two, one in early spring and a second after the first cut.

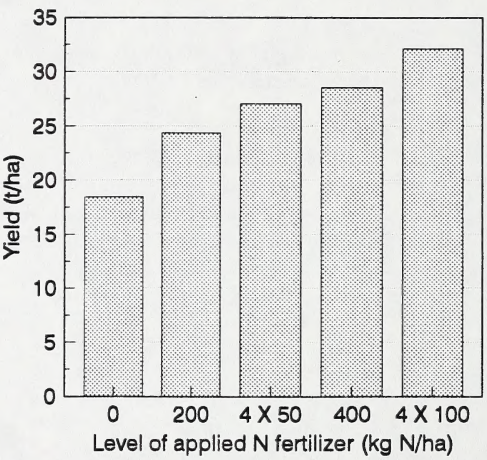


Fig. 2. Single initial vs annual N fertilizer

Good strategy but don't make it a hard and fast rule. Growing season rainfall is irregular and unpredictable, particularly in July and August, and split nitrogen applications will only give good results if there is water available. Base your fertilizer decision on growing season conditions. Apply half your nitrogen fertilizer in early spring. If good spring conditions produce a large first cut, the first application will be used up. Provided there is still reasonable moisture levels, apply the second half of your nitrogen right after the first cut comes off. If your first cut yields are down your second application may be reduced or eliminated because of the potential carry over of spring fertilizer.

In drier areas of the province, where only one cut of hay is harvested, there is no point in splitting the nitrogen application. It is however important to get the nitrogen on early in the spring to take advantage of early season moisture.

In general, ammonium nitrate produced greater forage yields than urea (see Figure 3). In most cases this is due to higher volatilization losses with urea compared to ammonium nitrate. Although, ammonium nitrate outperforms urea, it must be emphasized that urea is still a good source of nitrogen for forage crops when considering its lower cost and greater availability.

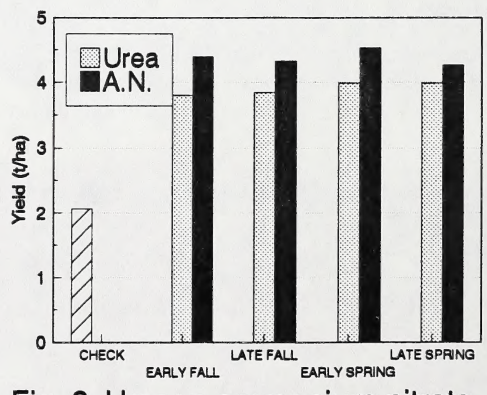


Fig. 3. Urea vs ammonium nitrate

You can improve the effectiveness of urea by placing the urea in bands below the soil surface using a disc bander. Band spacing is important. Bands spacings greater than nine inches tend to produce an uneven stand.

Legume forages, when properly inoculated, obtain their nitrogen from nodulating bacteria that convert atmospheric nitrogen to a plant available form. Consequently, fertilizer nitrogen is not required. Legumes will respond to nitrogen

fertilizer but too much fertilizer nitrogen will reduce the nitrogen fixing activity of the nodulating bacteria. This reduced activity may result in lower yields in subsequent years and can also reduce the life of the stand. Legumes are heavy phosphorus feeders and will not fix nitrogen without adequate sulphur. With pure legume stands, inoculating seed and ensuring adequate phosphorus and sulphur are present are your best nitrogen management tools.

Managing nitrogen fertility for mixed grass-legume forages is much more difficult than for pure grass or legume stands. If too much nitrogen is applied to a grass-legume mixture, the nitrogen fixation activity of the nodulating bacteria will be decreased. Legumes can't compete with grass in a nitrogen rich environment, so the grass will dominate the stand after a few years.

Generally, you can fertilize forage stands with more than 80% grass as a pure grass (moderate to high nitrogen applications), while forage stands with more than 80% legume should be treated as a pure legume stand (little or no nitrogen fertilizer application). For forage stands with between 20 and 80% legume, it is very difficult to manage the nitrogen fertilizer applications to maintain a desirable legume grass composition. Often the legume content can be reduced to less an 25% within three or four years when relatively small (25 - 50 kg N/ha) amounts of nitrogen are applied annually.

With it's effects on stand composition, longevity, forage quality and yield, nitrogen management should be an important part of your forage program. A well thought out strategy for managing nitrogen will go a long way towards helping you meet your production goals. ❀

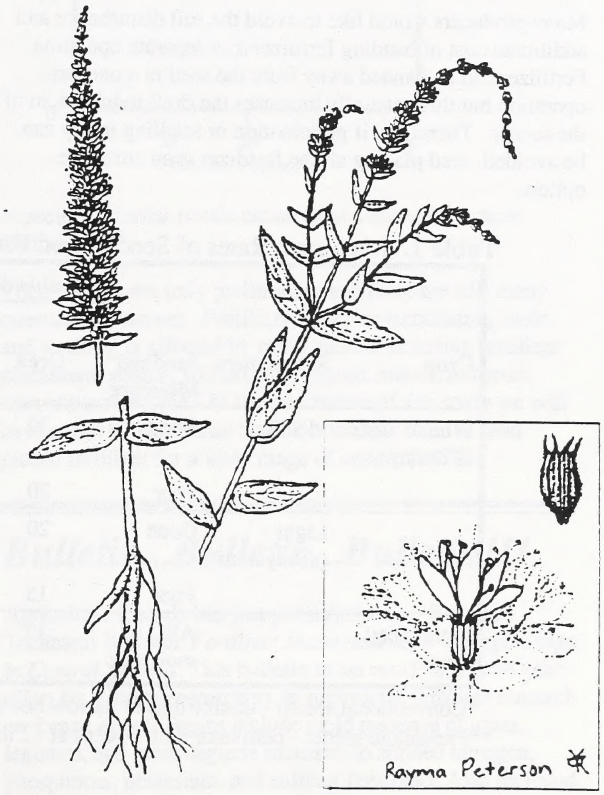
Purple Loosestrife Continued

In Alberta most sightings of purple loosestrife can be attributed to horticultural escapes. In the past, contradictory reports have circulated regarding the sterility of ornamental varieties of *Lythrum*. Recent research that not all ornamental cultivars are sterile when crossed with other cultivars of purple loosestrife. This also applies to the most common variety, Morden Pink, which can set seed when exposed to a suitable pollen source.

In January 1992, purple loosestrife was designated a noxious weed under the Alberta Weed Control Act. To address the concerns of purple loosestrife in Alberta, the Purple Loosestrife Action Committee was formed comprising members from all key stakeholder groups. The objective of the committee is to eradicate infestations of purple loosestrife in Alberta and to prevent the establishment of new infestations. The consensus of the committee is that purple loosestrife be given zero tolerance within the province. Eradication is the goal.

In light of the fact that cultivars of purple loosestrife are no longer considered as sterile plant, the Alberta Purple Loosestrife Action Committee will be encouraging the nursery trade to discontinue the sale of *Lythrum species*. They will also put in effect a program to educate the public on the environmental impact of purple loosestrife. Successful eradication will require everyone's participation. Please report all sightings of purple loosestrife and undertake eradication measures promptly.

For more information on purple loosestrife, please contact Shaffeck Ali, Chairman, Purple Loosestrife Action Committee, 2nd Floor Agronomy Centre, 6903-116 Street, Edmonton, Ablerta, T6H 4P2, (403) 427-7098.



Lythrum salicaria: Two examples of the flowering spike, and a root with attached leaves.

inset: a life-size example of a flower in one of the flower clusters, and enlarged detail of the seed capsule.

OPTIMAL RATES OF SEED PLACED FERTILIZER WITH AIRSEEDED CROPS

Doug Penney

How much fertilizer can I safely place with the seed? This is one of the questions most frequently asked by producers switching from conventional to direct seeding systems.

Seed placed fertilizer is both effective and convenient, but with double disc and narrow hoe openers, the maximum rate that can be applied before germination or seedling injury occurs is very limited. With small seeded crops like canola, most of the fertilizer must be broadcast or banded. Under many conditions, particularly minimum or zero-tillage systems, broadcast is less effective than band or seedrow placement.

Many producers would like to avoid the soil disturbance and additional cost of banding fertilizer as a separate operation. Fertilizer can be banded away from the seed in a one pass operation but this generally increases the draft requirement of the seeder. Therefore, if germination or seedling injury can be avoided, seed placing all the fertilizer is an attractive option.

Recognizing the obvious need for more information on fertilizer placement with airseeded crops, a group of agronomists and engineers with Alberta Agriculture, Food and Rural Development, and the fertilizer and crop industry initiated a research project in 1992. "Optimal Seed Placed Fertilizer with Airseeded Crops" is funded through the Alberta Agriculture Research Institute Matching Grant Program with support from the Alberta Canola Commission, Sherritt Gordon Fertilizer, Western Cooperative Fertilizers, Western Grains Research Foundation and several machinery manufacturers.

In the spring of 1992, a research airseeder was built by the Alberta Farm Machinery Research Centre in Lethbridge. This seeder allows us to quickly adjust both the rate and the spread of fertilizer in the seedrow. The thrust of the project is to find appropriate combinations of rates and spread for the different crops that allow optimization of seedrow placed fertilizer.

Two preliminary field experiments were established in late spring (seeded June 9 and 10) to determine how the 'research airseeder' would function in the field. Nineteen ninety three (1993) will be first full field research year. Field experiments with cereals and canola will be conducted at 10 locations in southern and central Alberta.

The results obtained with a double disc press drill and an airseeder giving a 4.5 inch scatter of seed and fertilizer are illustrated in Figure 1. The row spacing for both planters was 8 inches. In order to ensure adequate sulphur, the first 15 lb/ac of nitrogen was ammonium sulphate (21-0-0-24). Each additional increment of 15 lb/ac was urea (46-0-0) in one series of treatments and ammonium nitrate (34-0-0) in another.

Results indicate that higher rates may be safe when seed and fertilizer are scattered in bands wider than those typical of double disc or narrow hoe drills. Yields are low because of the late seeding date (June 10) and early frost but differences due to fertilizer injury are apparent.

Table 1. Maximum Rates of Seed Placed Fertilizer

			*double disc or narrow hoe drill		**Pneumatic seeder	
			lb/ac N		lb/ac N	
Crop	Soil texture	Seedbed Moisture	Urea	Ammonium nitrate	Urea	Ammonium nitrate
Wheat, Oats & Barley	Med fine	Good	30	45	45	65
		Poor	20	30	30	45
	Light (sandyloam)	Good	20	30	35	55
		Poor	15	20	25	35
Small Seed Crops		All moistures	10	10	20	35

*Conventional seeder - double disc or narrow hoe opener (1-2 inch spread of seed and fertilizer)
**Pneumatic seeder - cultivator with sweeps at 12 inch spacings giving a 50 % spread of seed and fertilizer

The current recommendations for nitrogen fertilizer in the seed row are shown in Table 1 (Alberta Fertilizer Guide - Agdex 541-1, May 1989). The guidelines for double disc or narrow hoe drills are based on several studies conducted in the prairie provinces. The guidelines for pneumatic seeders (50% spread) are based on very limited information from western Canada and a study conducted in North Dakota.

Discussions with producers and industry agronomists indicate that the Table 1 guidelines are too conservative. Their experience in the field shows that higher rates can be applied when seed and fertilizer are spread in a broad band.

Figure 1. Horizon Canola at Millet

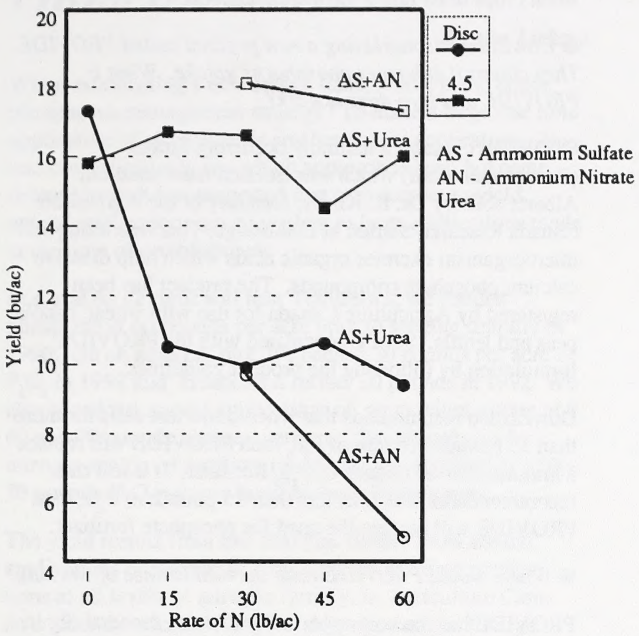
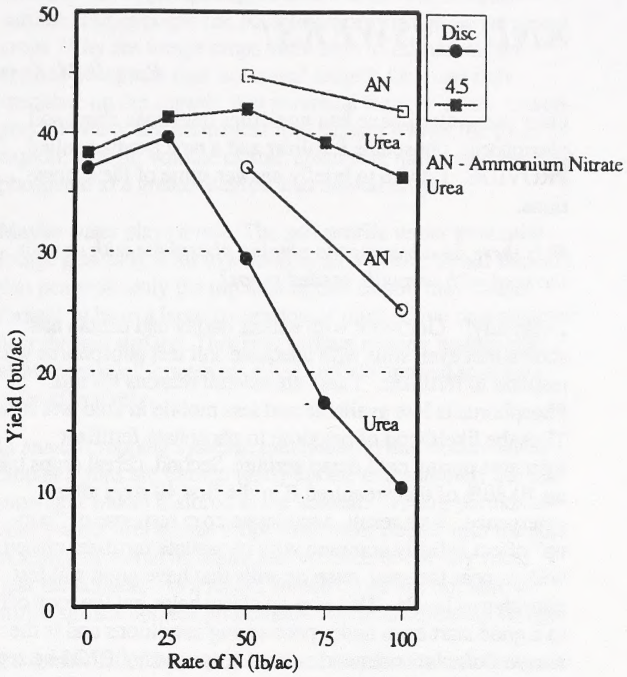


Figure 2. Duke Barley at Millet



With a 4.5 inch scatter of seed and fertilizer, no fertilizer injury occured even at the maximum rate of 60 lb N/ac. With the double disc press drill, all rates of nitrogen placed in the seed row reduced yield. Note that 60 lb N/ac as ammonium nitrate reduced yield more than urea. This is contrary to what was expected and also contrary to the results obtained in an adjacent trial with barley.

In the barley trial (Figure 2), urea reduced yield more than ammonium nitrate at both the 50 and 100 lb/ac rates as expected. Similar trends occurred at a second site near Calmar.

These results are only preliminary and there are still many questions to answer. Fertilizer injury to germinating seeds and seedling is affected by many factors including fertilizer placement, source, soil texture, organic matter, moisture, temperature and pH. At the conclusion of this study we will have a much better basis to determine safe rates of seed placed fertilizer for a wide range of conditions.❐

Hot Blues at the DA's

The 1993 Blue Book (Crop Protection with Chemicals) is hot off the press and available at all Alberta Agriculture district offices. The new edition contains several new chemicals and an update of new mixtures and formulation changes. A major feature in this year's edition is an update on the herbicide groups with respect to herbicide resistance.—Get yourself a 1993 Blue Book and recycle the old one.

June 30th, Breton Plots

What maintains soil quality while helping you diversify your cropping options? Forages, Forages, Forages!!!! The theme of this year's field day is *Forages - Underrated Crops*. Come and hear a trio of experts present new information on fertilizing forage crops and ideas about maintaining forage quality. Later join the plot tour and see the world renowned Classical Plots, in which forages have played a major role. We will also -show you some newer cropping systems with and without forages.

Program starts at 1000 hours, Wednesday, June 30, 1993. Note change from the traditional Friday. Lunch will be served at the plots. For further information, call Dr. Jim Robertson, University of Alberta at 492-3242.

Bulletin...Bulletin...Bulletin!!!

Agriculture Canada has just published a new Research Technical Bulletin, *Fertilizer Management for Forage Crops in Central Alberta*. This bulletin is the result of a three year effort by Alberta researchers to summarize fertilizer research on forage crops. Topics include yield response of grass, legumes, and grass-legume mixtures to applied nitrogen, phosphorus, potassium, and sulphur fertilizers. Also included are economics of fertilizer application, animal performance, and soil acidity. Limited copies are available from Agriculture Canada, Research Station, Bag Service 5000, (58 Street at the C&E Trail), Lacombe, Alberta, T0C 1S0.

PHOSPHORUS - QUESTIONS AND ANSWERS!

Ross H. McKenzie

Over the winter I have had numerous questions about soil phosphorus, phosphate fertilizer and a new product called PROVIDE. I'd like to briefly answer some of these questions.

● *Is there an advantage to placing phosphate with or near the seed with annually seeded crops?*

Definitely!! Our work with wheat, barley and canola has shown that even soils with adequate soil test phosphorus will respond to fertilizer. There are several reasons for this. Phosphorus is less available and less mobile in cold wet soils. Thus the likelihood of response to phosphate fertilizer increases during cold damp springs. Second, cereal crops take up 70-80% of their required P in the first 40 days after emergence. As a result, a moderate crop response or "pop-up" effect is fairly common with phosphate fertilizer placed with or near the seed, even on soils that have good soil test phosphorus levels. This pop-up effect helps get the crop off to a good start even under poor spring conditions and is the reason I often recommend at least 15 pounds of P2O5 be seed placed with annual crops.

● *How much phosphate fertilizer is taken up by the crop in the year of application?*

Crops will use from 5 to 40% depending on method of application, availability of soil phosphorus, and the type of crop. For cereal or oilseed crops that have fertilizer placed with or near the seed, the uptake is usually about 30 to 35%. That means 65 to 70% of the phosphate fertilizer remains in the soil for crop use in subsequent years.

● *Can phosphate fertilizer that is not taken-up in the year of application be lost from the soil?*

NO! Phosphate fertilizer is quite immobile and therefore is not prone to loss by leaching into subsoil. Also, it will not change into gaseous forms so it will not be lost to the atmosphere.

● *Will the remaining phosphate fertilizer that is not taken-up in the year of application be "fixed" into unavailable P forms?*

We recently examined both organic and inorganic soil phosphorus fractions in long-term rotation plots - Agriculture Canada's at Lethbridge and the University of Alberta's at Breton. Our work measured the amount of phosphate fertilizer applied over many years that had been changed to unavailable forms of soil phosphorus. If you want more detail see McKenzie et al. 1992. Can. J. Soil Sci. 72: 567-579 and 72: 581-589, but to make a long story short.....Only a very small amount of applied phosphate fertilizer will be "permanently fixed" into unavailable forms. Generally, phosphate fertilizer reacts in soil to form compounds that are not directly available to plants. These compounds act as a reservoir transforming back to available phosphorus fairly quickly when crops draw down the available pool.

● *DowElanco is marketing a new product called PROVIDE. They claims it enhances phosphorus uptake. What is PROVIDE and how does it work?*

PROVIDE contains a naturally occurring fungus (*Penicillium bilaii*) which was isolated from southern Alberta soils by Dr. R. Kucey, formerly of the Agriculture Canada Research Station at Lethbridge. This free living soil microorganism excretes organic acids which help dissolve calcium phosphate compounds. The product has been registered by Agriculture Canada for use with wheat, canola, peas and lentils. Seed is inoculated with the PROVIDE formulation by following the product guidelines.

DowElanco recommends that when a soil test calls for more than 15 pounds per acre of P_2O_5 then PROVIDE will replace a minimum of 10 pounds of P_2O_5 fertilizer. If a soil test recommendation calls for less than 15 pounds of P_2O_5 then PROVIDE will replace the need for phosphate fertilizer.

● *Where would PROVIDE have the best chance of working?*

PROVIDE has the best opportunity to work successfully in soils that have low soil test phosphorus and contain high levels of calcium phosphate compounds.

● *Where would PROVIDE have the least chance of working?*

PROVIDE will be least effective in soils containing low levels of calcium phosphate compounds. Generally, soils that would fall into this category would have one or more of the following characteristics: soil pH less than 6.5, high soil organic matter or sandy texture.

● *If phosphate fertilizer does not increase crop yield, will PROVIDE increase crop yield?*

No. Research results generally indicate that if phosphate fertilizer will not increase yield then neither will PROVIDE.

● *Is PROVIDE economical to use?*

Every farmer has their own unique situation. You must weigh the pro's and con's before making your own informed decision. Here's an example of how to look at the situation objectively.

Your going to seed canola in a field where the soil test recommends application of 25 pounds per acre of P_2O_5. You can band or seed place 25 pounds or band or seed place 15 pounds and use canola seed pre-inoculated with PROVIDE. If just fertilizer is applied, at a cost of $0.25 per pound P_2O_5, you would spend about $6.25 per acre. If fertilizer and PROVIDE are used, the 15 pounds of P_2O_5 fertilizer would cost about $3.75 per acre. The PROVIDE inoculated seed is $0.80 a pound more than un-inoculated seed. So at a

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FORAGE FERTILIZATION: PHOSPHATE

Jerome Lickacz

When establishing a new forage stand, which is the better phosphorus management strategy? To make a large one time application of phosphate or smaller annual applications. No one can definitively say which approach is best, but some recent research has suggested that with respect to yield annual applications are equivalent to large applications made at the time of establishment.

In a trial on Organic soil near Tomahawk, we banded phosphate at 60 pounds per acre prior to seeding timothy in 1990. On an adjacent plot, we banded 30 pounds per acre of P_2O_5 in 1991 and broadcast a further 30 pounds in 1992. We also broadcast annual applications of ammonium nitrate at 0, 60 and 90 pounds nitrogen per acre. This phosphorus by nitrogen matrix of fertilizer treatments was rounded of with 70 pounds K_2O per acre broadcast on all treatments.

The yield results from this trial (see figure) show annual applications of phosphate were equal to one time applications at all levels of nitrogen fertility. In Agriculture Canada's recently released *Fertilizer Management for Forage Crops in Central Alberta*, similar results were reported for forage grasses grown on mineral soils.

On grass forage, there isn't a clear yield advantage for either method of phosphorus application. With legumes, there may be some advantage to "banking" phosphate at time of seeding, but if so the advantage is very small. So your phosphorus management strategy can be based on cost and convenience without worrying too much about yield advantages.

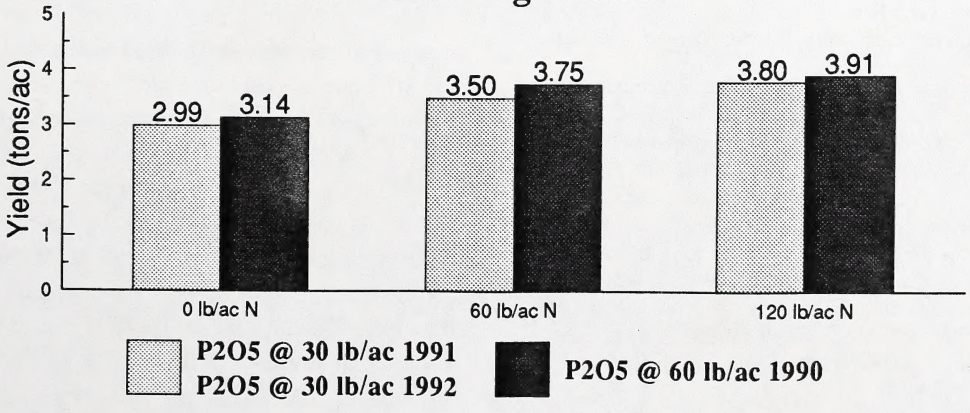
Central Alberta research suggests that forages can make effective use of phosphorus fertilizer at or near the soil surface. The opposite has been found in work done on cereal crops Why are forage crops more able to utilize surface applied phosphate than are cereal crops? One can only speculate on the answer. Are perennial forages better scavengers? Perhaps the permanent root system allows the plant to explore a larger volume of soil, absorbing native and residual phosphate to a greater degree than annual crops.

Maybe water plays a role. The soil profile under perennial forage generally dries to a considerable depth. Small showers that penetrate only the top inch or two of soil may cause forages to have a large proportion of their active root systems near the soil surface. This near surface rooting pattern may allow perennial forages to utilize surface applied nutrients quite effectively.

In annual cropping systems, precipitation that occurs when crop demands are limited (early spring and summer, fall and snowmelt water) is stored in the subsoil. During periods of heavy water use, annual crops send roots deeper into the soil in search of stored moisture and produce few if any roots near the surface. As a result, annual crops are not able to utilize surface applied phosphate as well as perennial forage.

It's somewhat of a paradox that in a province where forage is the major crop that so many questions about fertilizers and other aspects of forage agronomy still need answering. Soil and Crop Management Branch is proposing to help meet this challenge with a research program designed to evaluate the nitrogen, phosphorus, sulphur and selenium requirements of forage crops. Methods of fertilizer placement will also be investigated. Our aim is to get the first phase of this program up and running in the field this spring.✔

Effect of Annual and One-time Application of Phosphate on Yield of Timothy Grown on Organic Soil



Nitrogen applications are annual
Blanket application of 70 lbs/ac K2O

seeding rate of 5 pounds, PROVIDE would cost $4.00 per acre. The total cost of phosphate fertilizer and PROVIDE would be $7.75 per acre.
In the above situation, if you took a strict input cost point of view, you might choose to use only phosphate fertilizer. However, there are other costs to consider. Provide will reduce the amount of phosphate fertilizer you handle, in this case by more than a third. That means convenience and less stops to refill with fertilizer. What's that worth to you? Another factor to consider is that only 25 pounds of P_2O_5 can be safely placed with canola seed. So if your situation calls for more fertilizer than can be safely seed placed, using PROVIDE may be more convenient and cheaper than applying additional phosphate as a separate operation prior to seeding. Also this example is for canola. It is important to evaluate the economics for wheat, peas and lentils based on your individual farm situation.

● *Would I be better to use PROVIDE or simply apply a maintenance level of phosphate each year?*

Only you can make this decision!! It is my personal opinion that economics and logic must be used to make this decision. If there is very little price difference between PROVIDE versus phosphate fertilizer, a farmer might be better advised to annually apply phosphate fertilizer to replace what the crop removes, to maintain good residual levels of soil P. If the price of PROVIDE is substantially lower than the required phosphate fertilizer then utilizing PROVIDE might be the best choice. You should also consider the soil test phosphorus levels, the convenience of using PROVIDE and the costs of applying phosphate fertilizer when coming to a decision.

● *Should I try PROVIDE this spring?*

Again - only you can make this decision. My view has always been that you should only try a new product on your farm, if you feel that there is a reasonable chance of success. Also, you should do it on a small scale in the first year. That goes for trying anything new such as a new crop, new crop variety, new fertilizer types etc. The reason is that each farm and each farmer is different. Whenever feasible, evaluate new technology on your own farm first hand on a small scale. Make sure it's right for you before making changes on the whole farm.

These are just a few of the questions that have come up about the need for phosphate fertilizer and the use of PROVIDE. As always I encourage you to get a number of opinions so that you can make well informed decisions about your fertilizer needs. People that can be consulted include: your district agriculturist, regional soil specialist, the Soil and Crop Management Branch, fertilizer dealer, various industry agronomists, soil testing labs, Agriculture Canada research stations, and neighbours in your area with first hand experience. For specific information on PROVIDE, contact your local DowElanco agronomist or call their district office in Edmonton at 436-6131.

Good luck in producing top yields this year!

WHAT'S IN A NAME?

Walter Yarish

Last September, the Crop Protection and Soils Branches were joined to form the Soil and Crop Management Branch. The change is more than just a new name and the merger of some resources. It is a change in the way programs will be developed and delivered in future.

A branch review was initiated in November and is expected to be completed in June 1993. The purpose of the review is to develop a strategic plan for the next five years. A plan that will allow us to use our finite resources to most appropriately meet client needs. We are also making sure that our plans and programs are consistent with the industry strategey developed through *Creating Tomorrow*. In the next few months, we will be seeking input from clients and partners with whom the branch has worked in the past or will work with in the future. The findings from this review will form the basis of the branch's future direction and structure. During our discussions, we have been mindful of the following future scenarios:

★ Regulation will be more market driven.
★ Greater crop diversity and more niche marketing.
★ Sources of information outside government will increase.
★ Greater use of technology for managing information.
★ Percent of research funded by government will decrease.
★ Technology transfer will involve many organizations.
★ Free trade will force producers to least cost production.
★ Fee for service information and consultation.
★ Urban pressure on green issues - reducing pesticide use.

While the amalgamation process has seemed long and at times unsettling, we are well on the way to becoming an integrated branch delivering improved and innovative soil, crop, and pest management programs to the industry. During the transition, we will continue to provide our services as we have in the past. I am looking forward to discussing the details of our new direction and structure with you in the near future.

SOILutions is published three times a year by the Soil and Crop Management Branch, Alberta Agriculture. Your comments on current contents, ideas and contributions for future articles are welcome. For further information phone, fax, or write *Dan Heaney*, Soil and Animal Nutrition Laboratory, 905 O.S. Longman Bldg., 6909-116 st, Edmonton, Alberta, T6H 4P2, Phone (403)427-6361, Fax (403) 427-1439 **OR** *Elston Solberg*, Soil and Crop Management Branch, J.G. O'Donoghue Bldg., 7000-113 st, Edmonton, Alberta, T6H 5T6. Phone (403) 427-2530, Fax (403) 422-9745.